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Re: Written *Ex Parte* Statement of ARRL, the national association for Amateur Radio; ET Docket 04-37 -- Access Broadband over Power Line Systems; Response to Utilities Telecom Council's *Ex Parte* Statement Dated May 4, 2011.

Greetings:

ARRL, the national association for Amateur Radio, formally known as the American Radio Relay League, Incorporated (ARRL), hereby submits its response to the two-page, *ex parte* letter dated May 4, 2011, submitted by the Utilities Telecom Council (UTC). UTC's letter claims to be responsive to ARRL's November 30, 2010[1] *ex parte* submission in this proceeding. ARRL's November 30, 3010 filing provided ample justification for mandatory, full-time notching of Amateur Radio allocations by BPL systems to a required notch depth of approximately 35 dB.

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[1] UTC twice mistakenly states that ARRL's filing was "November 30, 2011." This is obviously an erroneous reference to November 30, 2010, the actual date of the ARRL Ex Parte filing to which UTC responds.

Introduction.

UTC's two-page letter (which, curiously, was filed more than five months after the ARRL submission to which it claims to be responsive) was not accompanied by any technical support whatsoever, and its statements are technically unsupported. ARRL's November 10, 2010 submission, by contrast, included numerous, *thorough* technical showings which, in the aggregate, affirmatively established the following:

1. Industry standards and most industry practice supports full-time notching of Amateur Radio allocations by Broadband over Power Line (BPL) systems.
2. Such a requirement, including a mandatory -35 dB notch depth, is feasible, and it can be implemented without any impediment to the BPL technology.
3. Full-time, mandatory notching of Amateur allocations has been determined to be both necessary for interference avoidance and successful in that respect.
4. The industry and the Commission have enough examples of interference cases to be able to distinguish between successful and unsuccessful BPL configurations.
5. The present regulations are clearly *insufficient* to protect incumbent Amateur Radio stations from interference from BPL systems, and if this technology has any residual potential for any applications at all, the regulations that govern it must be sufficient to avoid the interference potential that is well-known to be substantial and which has inhibited its development to date.

UTC's only substantive point is a claim that ARRL misrepresented IEEE Standard 1901 as mandating a full-time, -35 dB notch on Amateur Radio Service allocations. The following is submitted in rebuttal to that point and to the remaining unsupported and misleading arguments of UTC in its May 4, 2011 *ex parte* filing.

UTC's Ex Parte Filing.

UTC's two-page ex parte filing dated May 4, 2011 contains the following arguments:

- UTC claims that ARRL's argument was misleading because the IEEE Std. 1901 discusses notch depth of 35 dB only for wavelet OFDM BPL.
- UTC claims that 35 dB notching is not required under BPL industry standards.
- UTC claims that a notch depth of 35 dB is not necessary to protect incumbent operations in the Amateur Radio Service.
- UTC states that the Commission should allow BPL industries to voluntarily provide 35 dB notch depth (or not).
- UTC claims that imposing a 35-dB notch depth will cause BPL systems to operate with reduced throughput.

These claims by UTC are in error because they are based on a selective interpretation and misstatement of the content of the standards discussed, and of the content of other sources that ARRL described in its November 10, 2010 *ex parte* filing.

UTC's claims with respect to ARRL's November 10, 2010 Submission.

In its November 30, 2010 filing, ARRL reported on the notching required in a number of industry standards, not just IEEE Standard 1901. ARRL also reported therein on information published by or provided to ARRL by BPL manufacturers, and on numerous measurements of BPL systems made by ARRL, members of the BPL industry, regulators and other parties. *In these sources, notch depth was described or measured at depths ranging from 30 to over 40 dB.* It is true that some of the standards and other sources do not specifically mandate 35 dB notching. In some of the sources ARRL described, the stated notch depth is instead informative, and demonstrative of the capability of the state of the art. In others, notch depth may be specified as 30 dB, while in others, the notch depth is simply an authoritative measurement made that shows the capability of the present generation of BPL equipment. Whether 35 dB is chosen for the Commission's regulations, or 30 dB, or 40 dB, is a secondary issue; The critical point is that the state of the art of BPL system notching is far better than the 10- or 20-dB notching mandated in the current BPL rules, and that higher numbers – on the order of 35 dB – are achievable and can be implemented without adverse impact on the technology, and that full time, mandatory notching with substantially higher notch depths than are currently required by the Commission's rules are critical to interference avoidance.

UTC states that the 35 db notching described in IEEE Standard 1901 applies *only* to wavelet OFDM BPL technology, so it should not be applied to all BPL technology. While the clauses in Standard 1901 that were cited by ARRL do apply to wavelet OFDM, UTC fails to note that Standard 1901 applies to *two* BPL technologies, wavelet OFDM and FFT OFDM (HomePlug). UTC hides the fact that the Standard 1901 requirements for FFT OFDM (HomePlug) BPL are very specific, *and normative,* mandating a 30 dB spectral mask depth and normatively describing a "North America" mask that includes the frequencies for the US Amateur bands. In the FFT OFDM section of Standard 1901, the standard mandates that:

> *"A given carrier k is turned off if its presence will result in the transmitted spectrum violating the spectral mask."*

Contrary to the claims of UTC, ARRL did ***not*** mislead the Commission with respect to Standard 1901 in its filing. ARRL focused on the wavelet OFDM technology, primarily because in its earlier submissions in this proceeding, ARRL had already given considerable emphasis to HomePlug BPL technology.

Historically, ARRL and HomePlug have had a very productive relationship that has contributed to the state of the art of BPL and to interference avoidance. From an EMC perspective related to Amateur Radio, HomePlug has been a success. With many millions of HomePlug devices deployed in the US, ARRL has not to date received a single complaint of HomePlug interference to Amateur Radio. ARRL's views with respect to HomePlug technology have been made public repeatedly and there was no need to restate its position in its November 2010 filing. Nothing in ARRL's description of the capabilities described in Standard 1901, however, is misleading.

UTC's Claim that 35 dB Notching is not Required under BPL Industry Standards.

In its November, 2010 *ex parte* submission, ARRL described the content of a number of standards and reports of measured BPL system performance. Although the possible interpretations of these individual standards range from normative to informative, and the levels of specified notch depth may be somewhat different from standard to standard, it is misleading to summarize the content of all of these standards as "not requiring 35 dB notching" as does UTC now. Taking this range of requirements across a number of standards into consideration, a regulatory requirement for full-time notching of the United States Amateur allocations to a depth of -35 dB is manifestly justified and reflective of the intent of the body of standards and measurements cited.

Surely, a slightly different notch depth (in the range of -35 dB) could be adopted reasonably, but for UTC to interpret the body of work that those standards and measurements represent as an indication that mandatory notching to a depth on the order of -35 dB is "not required" is grossly misleading and irresponsible. The intent of Amateur band notching common to these standards is clear – it is necessary to protect sensitive Amateur Radio and other licensed operations, with a notch depth sufficient to not cause predictable[2] harmful interference to licensed radio services. This is the intent of regulators worldwide, and it should be the intent of the Commission as well.

UTC's Claim that a Notch Depth of 35 dB is Not Necessary to Protect Operation in the Amateur Radio Service.

UTC has not provided one iota of technical substantiation for its sweeping claim. Based on ARRL's work with HomePlug and visits to more than 20 BPL sites across the country, ARRL notes that a notch depth of 30 to 40 dB in deployed systems is *exactly* what *does* work to allow the deployment of BPL without creating widespread interference problems involving Amateur Radio. It is state-of-the-art for the industry and is easily achieved.

Furthermore, protection to the level that 35 dB of notch depth provides is not only necessary, it is *called for by international standards*. The ITU-R Recommendation SM.1879[3] (in-force) mandates that stations operating in the Amateur Service be protected to a level such that noise at the protected station is not increased by more than 0.5 dB.

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[2] ARRL reiterates that under the Commission's current rules, the interference potential of Access BPL systems to geographically proximate Amateur Radio stations is 100 percent.

[3] The impact of power line high data rate telecommunication systems on radiocommunication systems below 30 MHz.

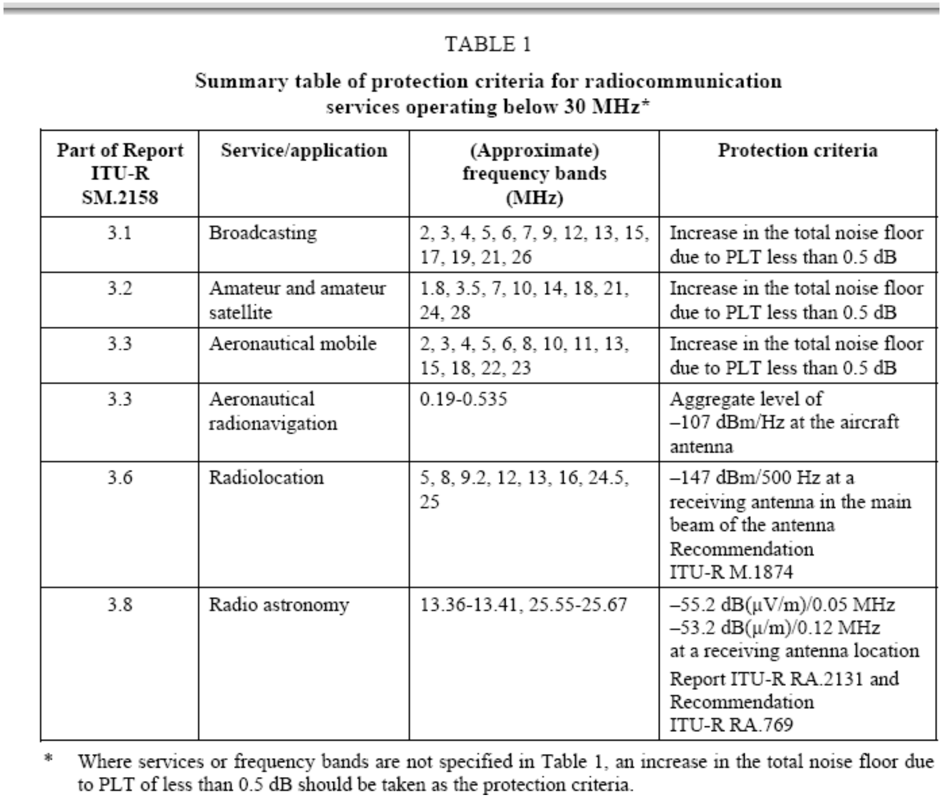

TABLE 1

Summary table of protection criteria for radiocommunication services operating below 30 MHz*

Part of Report ITU-R SM.2158	Service/application	(Approximate) frequency bands (MHz)	Protection criteria
3.1	Broadcasting	2, 3, 4, 5, 6, 7, 9, 12, 13, 15, 17, 19, 21, 26	Increase in the total noise floor due to PLT less than 0.5 dB
3.2	Amateur and amateur satellite	1.8, 3.5, 7, 10, 14, 18, 21, 24, 28	Increase in the total noise floor due to PLT less than 0.5 dB
3.3	Aeronautical mobile	2, 3, 4, 5, 6, 8, 10, 11, 13, 15, 18, 22, 23	Increase in the total noise floor due to PLT less than 0.5 dB
3.3	Aeronautical radionavigation	0.19-0.535	Aggregate level of –107 dBm/Hz at the aircraft antenna
3.6	Radiolocation	5, 8, 9.2, 12, 13, 16, 24.5, 25	–147 dBm/500 Hz at a receiving antenna in the main beam of the antenna Recommendation ITU-R M.1874
3.8	Radio astronomy	13.36-13.41, 25.55-25.67	–55.2 dB(μV/m)/0.05 MHz –53.2 dB(μ/m)/0.12 MHz at a receiving antenna location Report ITU-R RA.2131 and Recommendation ITU-R RA.769

* Where services or frequency bands are not specified in Table 1, an increase in the total noise floor due to PLT of less than 0.5 dB should be taken as the protection criteria.

Table 1 from the ITU-R SM.1879 Recommendation shows the required protection criteria from BPL technology for various radio services.

An increase of noise of 0.5 db is a reasonable basis to use as a protection criterion (although each 0.5 dB increase in noise is used to justify the next), determined by the broadest and strongest possible consensus available -- an ITU Recommendation.

SM.1879 refers to an ITU-R Report, SM.2158-1[4]. This report describes the signal levels that are necessary to achieve the 0.5 dB protection criterion, shown below in Table 3-4 of that document. These show the field strength at a distance of 10 meters that would be necessary to provide the specified 0.5 dB of protection. (Because SM.2158-1 shows levels at 10 meters instead of 30 meters, ARRL's Laboratory Manager Ed Hare has normalized its calculations in this report to 10 meters distance.)

Finally, the Commission has obviously already determined that notching is necessary to protect government facilities near BPL sites, since that requirement already appears in the Commission's BPL rules. Amateur stations are far more likely to be located near a BPL system than those operating on the frequencies that the rules presently protect.

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[4] Impact of power line telecommunication systems on radiocommunication systems operating in the LF, MF, HF and VHF bands below 30 MHz

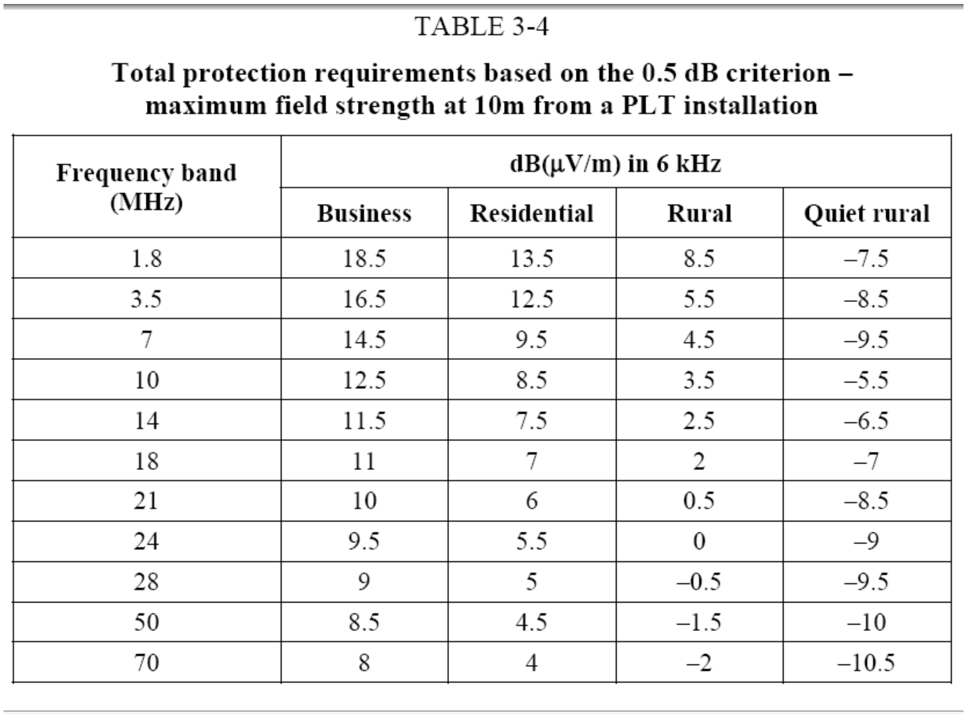

TABLE 3-4

Total protection requirements based on the 0.5 dB criterion – maximum field strength at 10m from a PLT installation

Frequency band (MHz)	dB(µV/m) in 6 kHz			
	Business	Residential	Rural	Quiet rural
1.8	18.5	13.5	8.5	–7.5
3.5	16.5	12.5	5.5	–8.5
7	14.5	9.5	4.5	–9.5
10	12.5	8.5	3.5	–5.5
14	11.5	7.5	2.5	–6.5
18	11	7	2	–7
21	10	6	0.5	–8.5
24	9.5	5.5	0	–9
28	9	5	–0.5	–9.5
50	8.5	4.5	–1.5	–10
70	8	4	–2	–10.5

Table 3-4 from the ITU-R SM.2158-1 report shows the level of field strength necessary to provide 0.5 dB of protection for the Amateur Radio Service, at 10 meters distance from the source in a 6 kHz bandwidth. (These data are normalized to 9 kHz and to 30 meters distance in Table 1 below.)

However, FCC field strength limits are specified for a distance of 30 meters from the radiating source. Table 1 below shows the amount of suppression that would be needed in the notches specified for BPL to meet the 0.5 dB degradation criterion specified in SM.1879.

Table 1 – Protection requirements

Frequency band (MHz)	Required protection level in 6 kHz at 10 m	Required protection level in 9 kHz at 10 m	FCC limit at 10 m (40 dB/decade)	Required notch depth
1.8	13.5 dBuV/m	15.3 dBuV/m	48.6 dBuV/m	33.3 dB
3.5	12.5 dBuV/m	14.3 dBuV/m	48.6 dBuV/m	34.3 dB
7	9.5 dBuV/m	11.3 dBuV/m	48.6 dBuV/m	37.3 dB
10.1	8.5 dBuV/m	10.3 dBuV/m	48.6 dBuV/m	38.3 dB
14	7.5 dBuV/m	9.3 dBuV/m	48.6 dBuV/m	39.3 dB
18	7.0 dBuV/m	8.8 dBuV/m	48.6 dBuV/m	39.8 dB
21	6.0 dBuV/m	7.8 dBuV/m	48.6 dBuV/m	40.8 dB
24	5.5 dBuV/m	7.3 dBuV/m	48.6 dBuV/m	41.3 dB
28	5.0 dBuV/m	6.8 dBuV/m	48.6 dBuV/m	41.8 dB
50	4.5 dBuV/m	6.3 dBuV/m	48.6 dBuV/m	42.3 dB
70	4.0 dBuV/m	5.8 dBuV/m	48.6 dBuV/m	42.8 dB

Table 1 – This shows the field-strength level necessary to meet the protection requirement of 0.5 dB increase in noise in residential environments. These data show the maximum field strength extrapolated to 10 m distance from a BPL installation. These data are adjusted for a 9 kHz bandwidth. Because FCC rules extrapolate using 40 dB/decade, that extrapolation factor was used here to show the notch depth required under the conditions set by the current FCC rules; ARRL's position is that this extrapolation factor, however, is not scientifically justifiable and should be changed in the BPL Rules. Attached hereto as ***Exhibit A*** *is an analysis of signal decay based on ITU-R Report SM.2158-1, "Impact of power line telecommunication systems on radiocommunication systems operating in the LF, MF, HF and VHF bands below 80 MHz." The data shows the results of measurements made of in-premise BPL systems at distances of 3 and 10 meters. The data show that the field strength generally decays with distance at an approximately 20 dB/decade rate.*

UTC's Claim That Notching the Amateur Bands Should be Voluntary

UTC has taken the position that notching of -35 dB should be "voluntary." The development of good industry standards and effective regulations often drive each other to good effect. Especially with industry standards, the consensus and balloting process relies heavily on the confidence that balloters place in the premise that the portions of the standard that represent their stake will be followed by those with other stakeholder interests. That value is strengthened when regulators adopt successful standards and models into equally successful regulations. That value is weakened when some stakeholders seek to avoid the responsibilities outlined in standards. The premise that the principles described in a number of standards, and demonstrated by industry practice, should be "voluntary" also undermines the credibility of the standard. UTC's statement raises more questions than answers, as it claims that implementing -35 dB notching will harm the performance of the technology, yet claims to FCC that the industry should be expected to implement such notching voluntarily. The number of interference cases in which notches were not in place makes UTC's suggestion glaringly irresponsible. Those who fail to learn from history are doomed to repeat it.

Furthermore, ARRL has submitted in the record in this proceeding numerous examples (including current examples) of instances of BPL installations which have not "voluntarily" followed the standards and have not "voluntarily" turned off carriers in the Amateur bands, as called for by the standards, leading to instances of actual interference. Voluntary notching has been shown not to work because there are economic incentives by the BPL companies to not follow the standards. The rules should reflect what is necessary and achievable in order to minimize the interference potential. There is no reason *not* to make full-time, -35 dB notches mandatory in the revised BPL rules.

UTC's claim that Notching to 35 dB of Attenuation will Degrade BPL System Performance

UTC claims that requiring a 35 dB notch will unacceptably degrade BPL-system performance. It has offered *no technical study or documentation in support of that claim*. Although the effect of turning off carriers has not been fully studied, BPL systems are, by design, able to accommodate the inevitable loss of carriers that will occur naturally in a BPL deployment. The forward-error correcting that takes place in all BPL protocols runs whether carriers are lost or not, so the systems can suffer the loss of some carriers without degradation.

This has been evaluated in a study conducted by the European Telecommunications Standards Institute (ETSI)[5]. This study reviewed the effect of dynamic notching of shortwave broadcast spectrum, although in this study, the notching was implemented manually. It must be noted that although dynamic notching may work for the protection of the reception of strong international broadcast stations, it is not a viable solution for the protection of stations operating in the Amateur Radio Service. Amateur signals are often at or very near the noise floor so they are not going to be reliably sensed by any dynamic-notching protocol.

Part of the study evaluated the effect of implementing the notching on the data rate of the BPL system, describing the data rates with and without notching in place. This testing was done in the Fall of 2007.

Automatic Notching of HF Broadcast Spectrum:

The auto-detecting process involves having the device essentially listen to the HF spectrum. When worldwide ionospheric propagation is not occurring on a given portion of the HF spectrum, there are no strong signals. When significant propagation exists to the geographical area where a BPL modem is located, the modem detects the strong signals and turns off the nearest carriers to the strong detected signal. The technical premise is that the BPL system can use HF spectrum that does not have good propagation at the time, but when propagation allows that spectrum to propagate to a given area, the BPL system will turn off that spectrum, allowing that spectrum to be used locally for its allocated use.

In general, the conclusion of the study is that the detection process of the notching works and once notching is enabled the impact of the BPL devices on nearby HF broadcasting is minimal. Although ARRL does not have the standing to speak for the HF broadcasting stakeholders on the effectiveness of the notching, *the study does show that notching is necessary to protect locally used spectrum*. The study also shows that BPL systems operate at radiated levels well above the minimum necessary signal level for HF broadcast reception. To avoid causing harmful interference to HF broadcasting, BPL systems must operate at a level that does not significantly degrade the noise floor on which the minimum broadcast signal level is based.

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[5] ETSI TR 102 616 - PowerLine Telecommunications (PLT) Report from Plugtests™ 2007 on coexistence between PLT and short wave radio broadcast; Test cases and results.

The auto-notching technique would not work well for the Amateur Radio Service. Amateur signals can and are present during times of minimal ionospheric propagation. These signals often take advantage of weaker propagation modes such as backscatter, allowing effective communication under circumstances that would generally not be acceptable for public broadcast purposes. HF broadcast stations can and do use megawatts of EIRP, compared to Amateur signals that are always below 1500 watts of transmitter power in the US and that often use power levels of 100 watts or less. In many cases, Amateur operation consists of listening only, transmitting only if called upon in an emergency net, for example. The best mitigation technique for the Amateur Radio Service remains to continue to notch Amateur spectrum with state-of-the-art notching as a good general solution.

Data Rates

The study also describes the data rates that were achieved by the BPL systems under test with and without notching. This is the part of the study that is of the most interest to ARRL, although that interest is indirect. One objection sometimes raised by the BPL industry is that notching spectrum causes BPL systems to operate at lower data rates. Clearly if taken to extremes, this has to be true, as one carrier could not carry the same data as multiple carriers when operating in an environment where noise has an uneven distribution vs spectrum.

There are, however, several findings evident in this study:

- The loss of data with notching is not substantial.
- In some cases, notching spectrum that is being affected by strong interference ***improved*** the data rate.
- There is no consistency to the degree to which notching affects the data rate (in either direction) relative to other factors such as conductor losses and the physical architecture of the premise carrying the BPL signal.
- The data rate available to the end user is influenced by other factors (primarily the physical architecture of the local wiring carrying the BPL signal), significantly overshadowing other factors such as notching.

These factors are important. Although the overall trend is for a slight reduction in data rate with notching, the reduction is not harmful. It is evident that some degree of notching can be implemented without degrading the BPL system significantly. The tradeoffs needed to effectively protect local spectrum users can be achieved at low performance cost to the operation of the BPL system.

The following represent the findings with respect to data rate reduction or improvement with notching enabled: The testing was done in a Laboratory and in-situ environment, using 2nd-generation DS2 and Sony BPL modems as the equipment under test. The testing in the laboratory showed a significant change with notching only under high-loss circumstances. The in-situ testing showed much less change in data rate, ranging from -5.5% to +0.0% change when notching of broadcast spectrum was enabled,

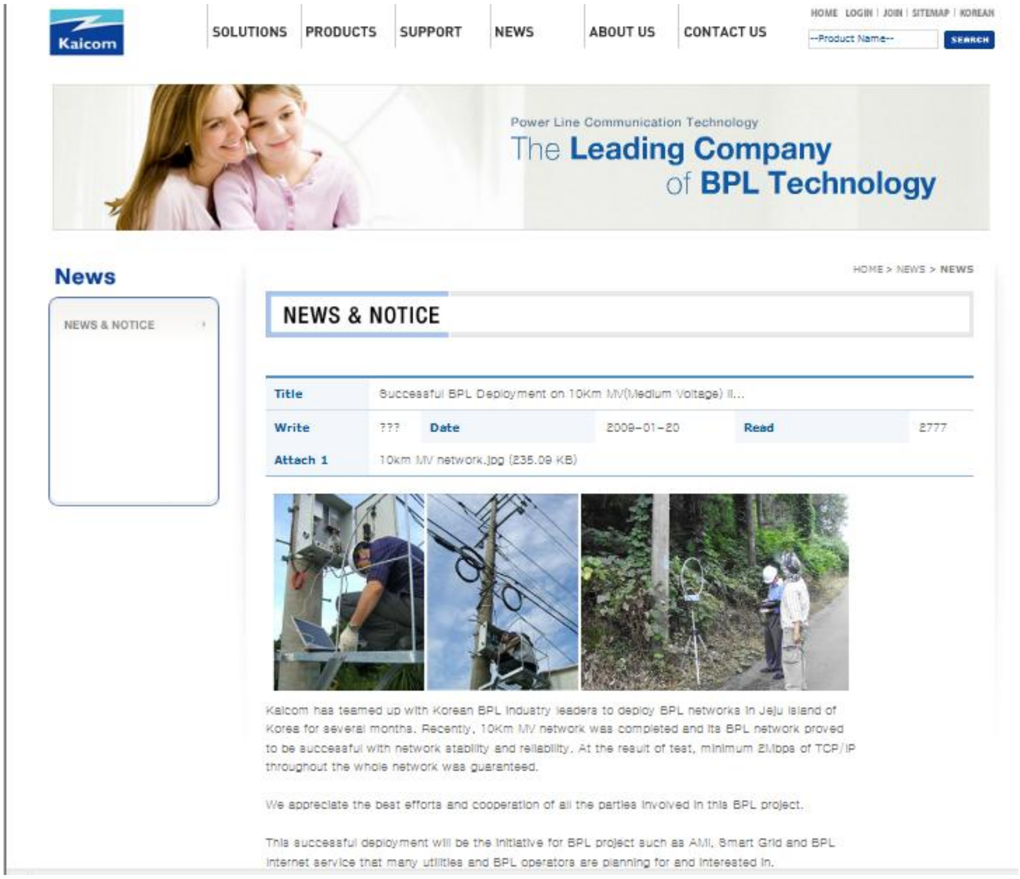
Table 1: Summary of data rate testing

Conditions	BPL type	Phy layer data rate notching off	Phy layer data rate notching on	End user data rate notching off	End user data rate notching on	From report Table #
Lab 20 dB loss	Sony	202	199 -1.5%	59	58 -1.7%	Table 13
Lab 40 dB loss	Sony	199	184 -7.5%	58	56 -3.5%	Table 13
Lab 60 dB loss	Sony	71	90 **+26.8%**	27	33 +22%	Table 13
Lab 20 dB loss	DS2	--	--	94	90 -4.3%	Table 14
Lab 40 dB loss	DS2	--	--	91	86 -5.5%	Table 14
Lab 60 dB loss	DS2	--	--	68	43 -36.8%	Table 14
In building #1	Sony	199	195 -2.0%	58	57 -1.7%	Table 16
In building #2	DS2	--	--	91	86 -5.5%	Table18
In building #2	Sony	202	202 +0.0%	59	59 +0.0%	Table 20
In building #3	Sony	172	168 -2.3%	52	51 -1.9%	Table 22

Table 1 above shows that the impact of the significant notches that were present during the testing of the capabilities of notching to protect HF shortwave broadcast spectrum generally had a negligible effect on the system performance and cases where the BPL signal to the end receiver is marginal, may actually improve performance.

Korean BPL regulations

UTC claims that notching in general, especially the few extra carriers they claim need to be notched to achieve 35 dB of notch depth, will cause poor BPL performance. The ETSI testing is the best available evidence that this is demonstrably not true. Other nations' BPL rules address the question of notching the Amateur bands directly. The Republic of Korea has developed rules that require that the Amateur and aeronautical and marine safety bands be permanently notched. This is significant for a number of reasons. First, the Republic of Korea is the home to Kaicom, a BPL equipment manufacturer. The news release below shows that Kaicom has successfully deployed BPL in the Republic of Korea. This is a very strong indication that, contrary to UTC's claims, permanent notching to protect the Amateur bands is a much a part of Kaicom's success as it has been for HomePlug products worldwide. These rules and the successful deployment within their framework show that rather than being the major impediment to BPL's being able to successfully operate, fixed notching is something that can and is being done by countries with a strong economic incentive to promote good BPL regulation.



Title	Successful BPL Deployment on 10Km MV(Medium Voltage) ll...				
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Attach 1	10km MV network.jpg (235.09 KB)				

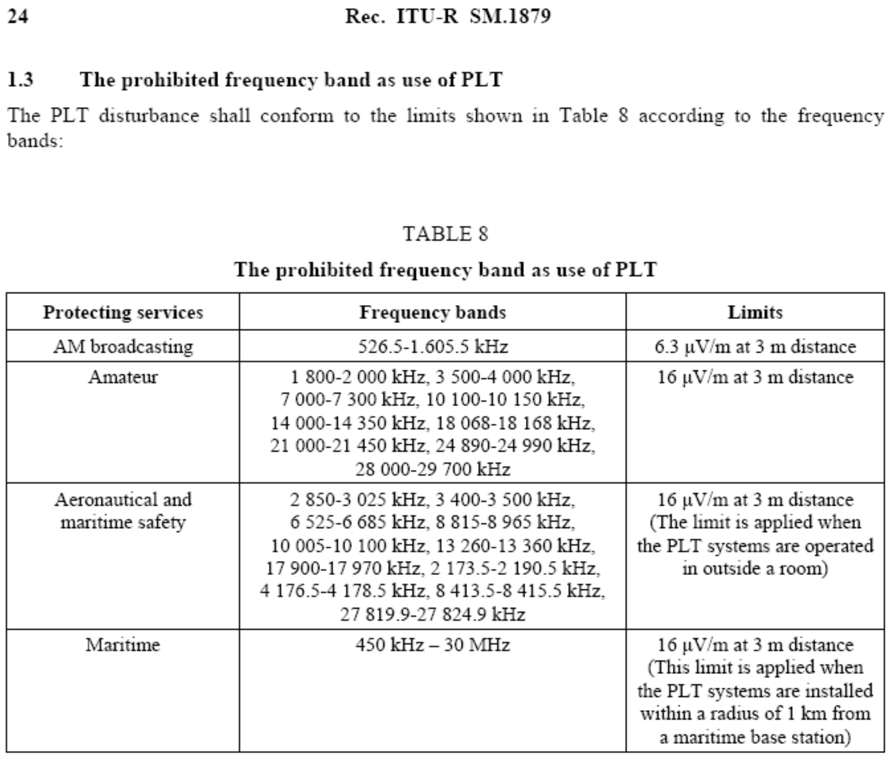
Kaicom has teamed up with Korean BPL Industry leaders to deploy BPL networks in Jeju island of Korea for several months. Recently, 10Km MV network was completed and its BPL network proved to be successful with network stability and reliability. At the result of test, minimum 2Mbps of TCP/IP throughout the whole network was guaranteed.

We appreciate the best efforts and cooperation of all the parties involved in this BPL project.

This successful deployment will be the initiative for BPL project such as AMI, Smart Grid and BPL internet service that many utilities and BPL operators are planning for and interested in.

Figure 1 – This news release from the Kaicom BPL manufacturer located in the Republic of Korea shows a successful BPL deployment under rules that require full-time notching of the Amateur bands.

The tables below show the permitted operating levels in the Republic of Korea. Table 8, shown first, sets a requirement for permanent notching of Amateur and other spectrum, at a level that is 38 dB below the permitted operating levels shown in Table 7. This is consistent with the 35 dB figure that ARRL has proposed for notching of Amateur spectrum.



24 Rec. ITU-R SM.1879

1.3 The prohibited frequency band as use of PLT

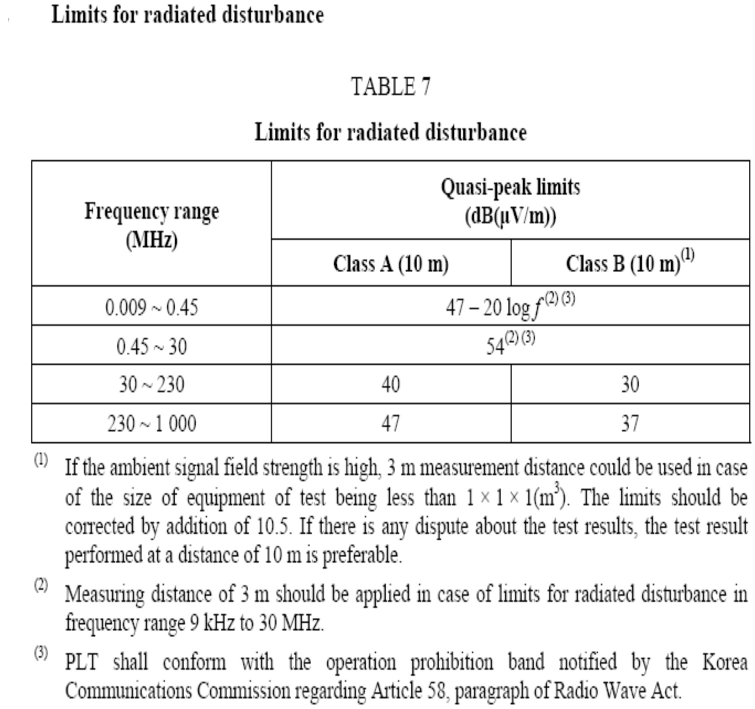
The PLT disturbance shall conform to the limits shown in Table 8 according to the frequency bands:

TABLE 8

The prohibited frequency band as use of PLT

Protecting services	Frequency bands	Limits
AM broadcasting	526.5-1.605.5 kHz	6.3 µV/m at 3 m distance
Amateur	1 800-2 000 kHz, 3 500-4 000 kHz, 7 000-7 300 kHz, 10 100-10 150 kHz, 14 000-14 350 kHz, 18 068-18 168 kHz, 21 000-21 450 kHz, 24 890-24 990 kHz, 28 000-29 700 kHz	16 µV/m at 3 m distance
Aeronautical and maritime safety	2 850-3 025 kHz, 3 400-3 500 kHz, 6 525-6 685 kHz, 8 815-8 965 kHz, 10 005-10 100 kHz, 13 260-13 360 kHz, 17 900-17 970 kHz, 2 173.5-2 190.5 kHz, 4 176.5-4 178.5 kHz, 8 413.5-8 415.5 kHz, 27 819.9-27 824.9 kHz	16 µV/m at 3 m distance (The limit is applied when the PLT systems are operated in outside a room)
Maritime	450 kHz – 30 MHz	16 µV/m at 3 m distance (This limit is applied when the PLT systems are installed within a radius of 1 km from a maritime base station)

Table 8 from the ITU-R Recommendation SM-1879 shows in an informative Annex the requirements to notch Amateur and other spectrum found in the BPL regulations of the Republic of Korea.



Limits for radiated disturbance

TABLE 7

Limits for radiated disturbance

Frequency range (MHz)	Quasi-peak limits (dB(µV/m))	
	Class A (10 m)	Class B (10 m)(1)
0.009 ~ 0.45	$47 - 20 \log f$ (2) (3)	
0.45 ~ 30	54(2) (3)	
30 ~ 230	40	30
230 ~ 1 000	47	37

(1) If the ambient signal field strength is high, 3 m measurement distance could be used in case of the size of equipment of test being less than 1 × 1 × 1(m^3). The limits should be corrected by addition of 10.5. If there is any dispute about the test results, the test result performed at a distance of 10 m is preferable.

(2) Measuring distance of 3 m should be applied in case of limits for radiated disturbance in frequency range 9 kHz to 30 MHz.

(3) PLT shall conform with the operation prohibition band notified by the Korea Communications Commission regarding Article 58, paragraph of Radio Wave Act.

Table 8 from the same report shows the limits for radiated emissions from BPL devices in the Republic of Korea.

Conclusions.

UTC's two-page, unsupported statements are baseless. ARRL's November 30, 2010 and its prior and subsequent submissions in this proceeding amply justify the modifications of the BPL rules urged by ARRL, including the mandatory, full-time notching of all Amateur Radio allocations by BPL systems, to a notch depth of approximately -35 dB. It has now been almost *two years* since the Commission issued its Further Notice in this proceeding, and well more than *three years* since the Court of Appeals remanded this matter to the Commission for further proceedings. It is long past time that the Commission adopted rules that will finally address, *ex ante*, the interference potential of Access BPL and allow this technology to succeed or fail in the marketplace without the specter of spectrum pollution that the current rules clearly permit.

Yours very truly,

Christopher D. Imlay
Christopher D. Imlay
General Counsel, ARRL

Attachments
Exhibit A

Copies to: All Commissioners

Exhibit A

Analysis and discussion of measurements of BPL systems with distance as reported in ITU-R SM.2158-1, “Impact of power line telecommunication systems on radiocommunication systems operating in the LF, MF, HF and VHF bands below 80 MHz”

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21 June 2011

SM.2158-1 measurements of BPL devices

The following graphs are excerpted from the SM.2158-1 ITU-R Report, Impact of power line telecommunication systems on radiocommunication systems operating in the LF, MF, HF and VHF bands below 80 MHz. These data show the results of measurements made of in-premise BPL systems at distances of 3 and 10 meters. The data show that the field strength generally decays with distance at an approximately 20 dB/decade rate.

The results are summarized in Table 1 below:

Table 1: Decay of field strength with distance from in-premise BPL systems described in SM.2158-1.

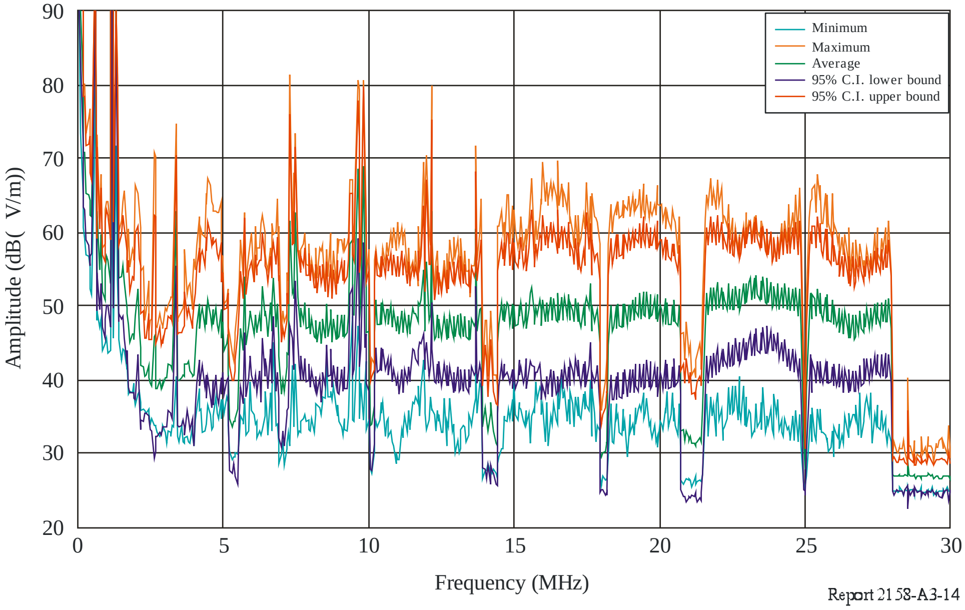
Device#	Frequency	Field strength at 3 m (average)	Field strength at 10 m (average)	Decay rate dB/decade
HD-PLC	8 MHz	48 dBuV/m	39 dBuV/m	17.2
	17 MHz	50 dBuV/m	39 dBuV/m	21.0
	23 MHz	52 dBuV/m	41 dBuV/m	21.0
HomePlug AV	8 MHz	55 dBuV/m	44 dBuV/m	21.0
	17 MHz	54 dBuV/m	43 dBuV/m	21.0
	23 MHz	51 dBuV/m	41 dBuV/m	19.1
UPA	8 MHz	53 dBuV/m	42 dBuV/m	21.0
	17 MHz	53 dBuV/m	41 dBuV/m	23.0
	23 MHz	53 dBuV/m	42 dBuV/m	21.0

Figures from the ITU-R SM.2158-1 report on BPL

The following figures were excerpted from the ITU-R SM.2158-1 report on BPL. They show measurements made by CRC of in-premise BPL devices.

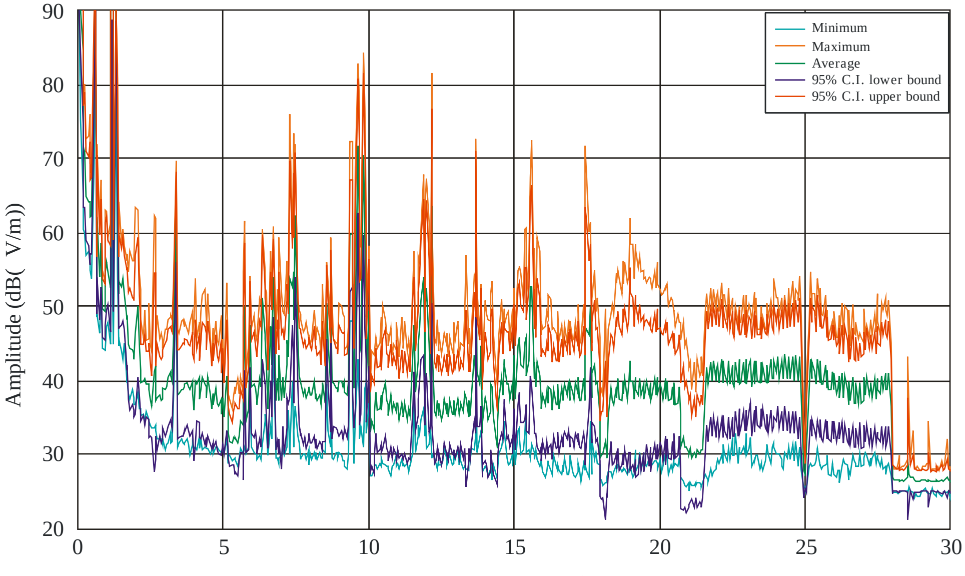
Figure A3-14

RF field strength distribution, PLT Device 2 (HD-PLC) at 3 m



Report 2158-A3-14

Figure A3-15
RF field strength distribution, PLT Device 2 (HD-PLC) at 10 m



Report 2158-A3-15

Figure A3-16

RF field strength distribution, PLT Device 3 (Homeplug AV) at 3 m

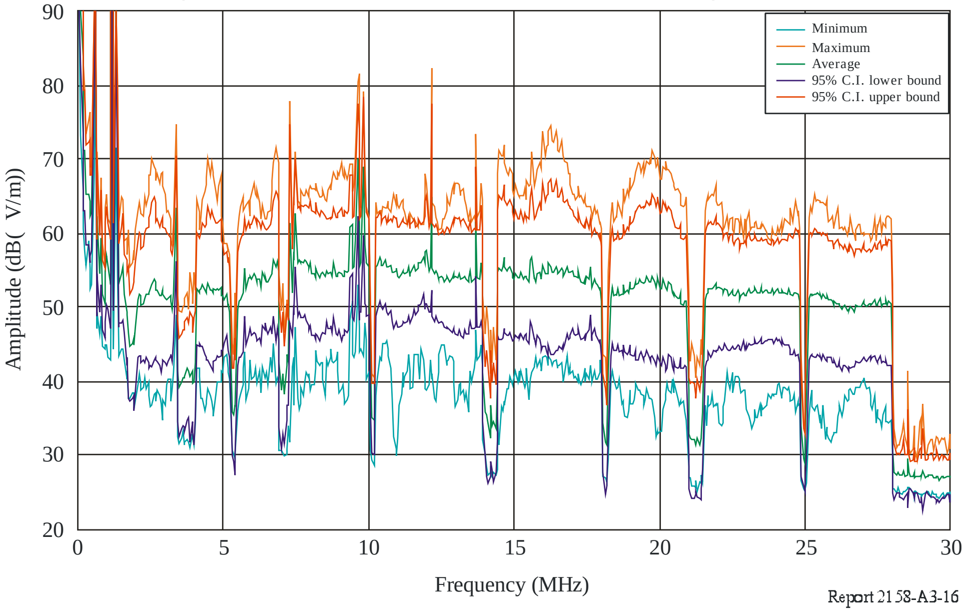


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Figure A3-17

RF field strength distribution, PLT Device 3 (Homeplug AV) at 10 m

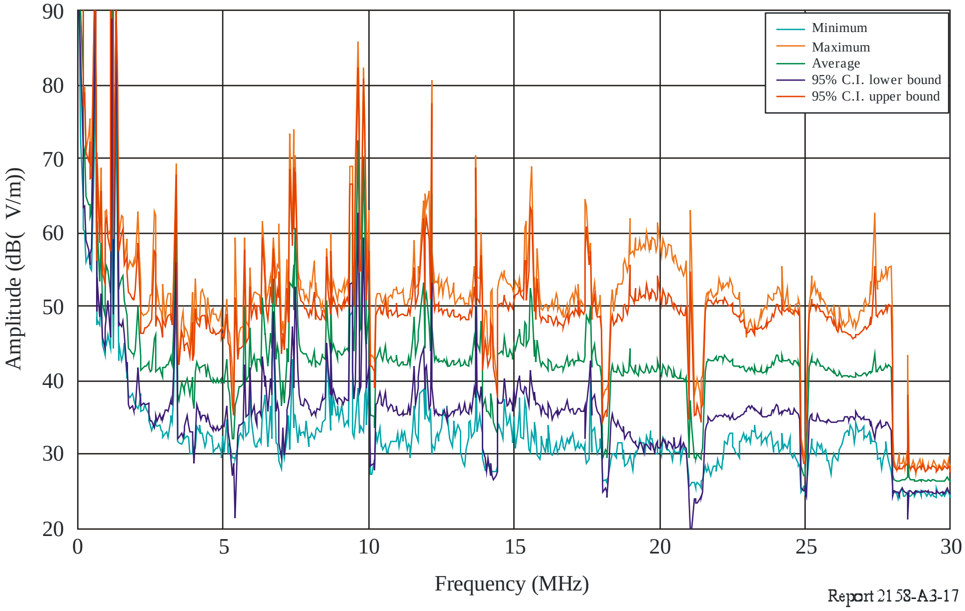

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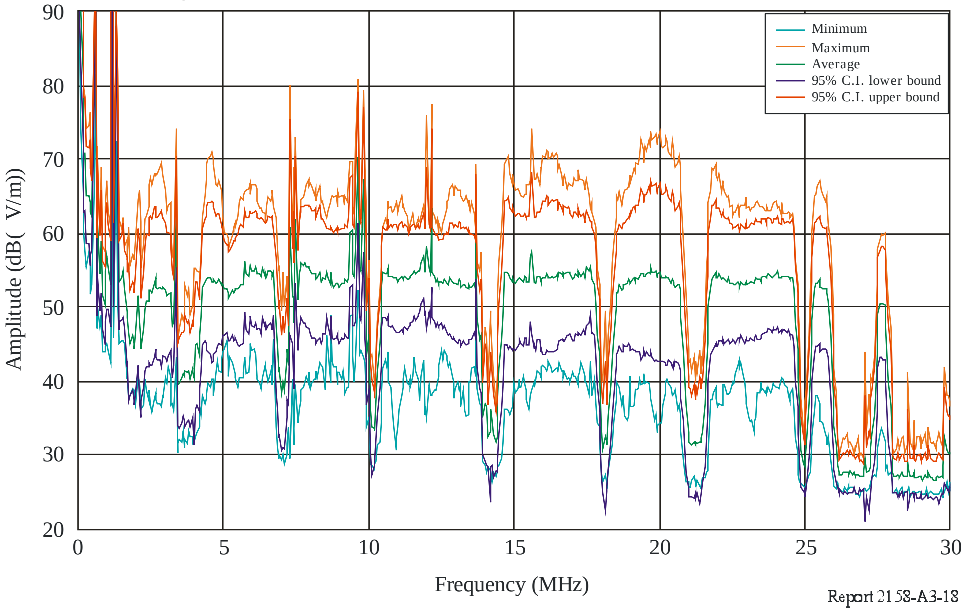
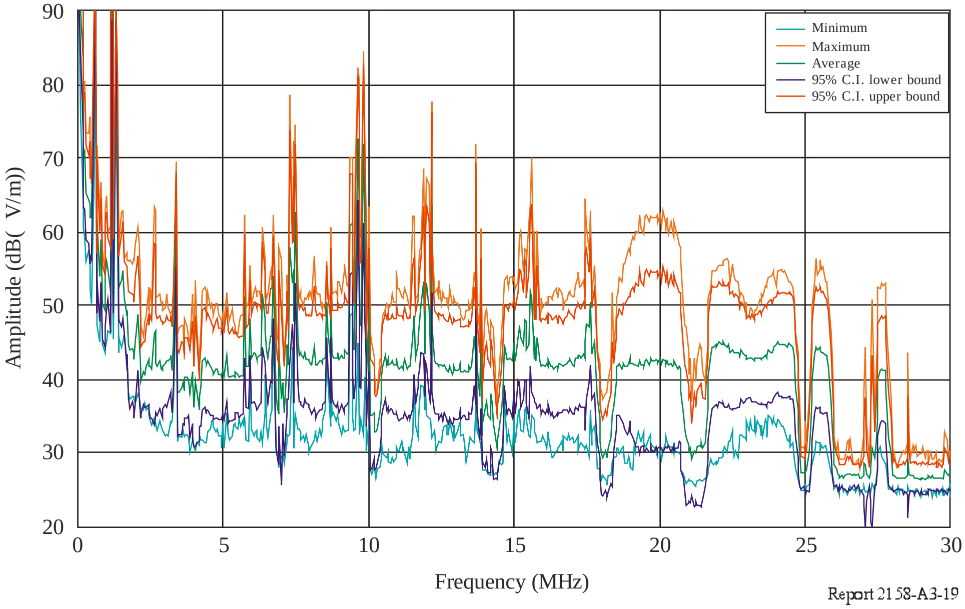
Figure A3-18
RF field strength distribution, PLT Device 6 (UPA) at 3 m



Report 2158-A3-18

Figure A3-19
RF field strength distribution, PLT Device 6 (UPA) at 10 m



Report 2158-A3-19